

CLAIMS

What is claimed is:

- 1 1. A learning internetwork switch for use in a network that includes a plurality of
2 virtual local area networks, the learning internetwork switch comprising:
3 a first set of ports connecting the learning internetwork switch to a set of
4 virtual local area networks, wherein each virtual local area network of
5 the set of virtual local area networks is a virtual local area network of
6 the plurality of virtual local area networks that is locally attached to the
7 learning internetwork switch;
8 a second set of ports connecting the learning internetwork switch to a router,
9 wherein devices that belong to the virtual local area networks in the set
10 of virtual local area networks communicate with the router by
11 transmitting packets through the learning internetwork switch; and
12 a learning mechanism that inspects control packets sent between the router and
13 the devices, the learning mechanism storing association data that
14 indicates a correspondence between data link layer addresses, network
15 layer addresses, and the first set of ports based on information
16 contained in the control packets;
17 said learning internetwork switch using said association data to forward traffic
18 between locally attached virtual local area networks.
- 1 2. The learning internetwork switch of Claim 1 wherein:

2 a third set of ports on the router connect the router to the second set of ports;
3 and
4 the learning mechanism is further configured to store data indicating a
5 correspondence between data link layer addresses of the third set of
6 ports and network layer addresses of the third set of ports based on
7 information contained in the control packets.

1 3. The learning internetwork switch of Claim 1 further including a proxy
2 forwarding mechanism configured to:
3 detect when a packet sent by a first device of a first virtual local area network
4 in the set of virtual local area networks contains a data link layer
5 destination address associated with the router and a network layer
6 destination address associated with a second device of a second virtual
7 local area network in the set of virtual local area networks;
8 determine the data link layer address of the second device based on the
9 network layer address of the second device;
10 replace in the packet the data link layer destination address associated with the
11 router with the data link layer address associated with the second
12 device; and
13 transmit the packet through the port of the first set of ports to which the second
14 device is connected.

1 4. The learning internetwork switch of Claim 1 wherein:

the control packets include packets which are request packets that request a data link layer address of a port of the router; and the request packets contain a data link layer source address associated with the device sending the packet, a network layer source address associated with the device sending the packet, and a network layer destination address associated with the port of the router.

5. The learning internetwork switch of Claim 3 wherein:

the packet includes a data link layer source address associated with the first device; and the proxy forwarding mechanism is further configured to: determine a data link layer address associated with a port of the router which serves as a default gateway to the second virtual local area network; and replace in the packet the data link layer source address associated with the first device with the data link layer address associated with the port of the router which serves as the default gateway to the second virtual local area network.

6. A method, for use by a learning internetwork switch connected to a router, for determining locations of devices that belong to a set of virtual local area networks locally attached to the learning internetwork switch, the method comprising the steps of:

5 receiving at a first port a packet from a device that belongs to one of the virtual
6 local area networks, wherein the packet includes a network layer
7 destination address that corresponds to a particular port of the router;
8 determining whether the packet is a request for the data link layer address of
9 the particular port of the router;
10 if the packet is a request for the data link layer address of the particular port of
11 the router, then
12 reading a data link layer source address and a network layer source
13 address from the packet;
14 storing data indicating that the data link layer source address
15 corresponds to the network layer source address;
16 storing data indicating that the device that originally transmitted the
17 packet is connected to the first port; and
18 forwarding the packet to the particular port of the router.

1 7. The method of Claim 6 further comprising the steps of:
2 if the packet contains a message to be sent through the router to a second
3 device that belongs to a second virtual local area network of the set of
4 virtual local area networks, then performing the steps of:
5 reading from the packet a network layer destination address associated
6 with the second device;

7 performing a lookup operation to determine if configuration
8 information has been stored for the network layer destination
9 address;
10 if configuration information has been stored for the network layer
11 destination address, then reading the configuration information
12 to determine a data link layer address of the second device and
13 that the second device is connected to a second port of the
14 learning internetwork switch; and
15 forwarding the packet to the second device through the second port.

1 8. The method of Claim 7 wherein the step of forwarding the packet includes the
2 steps of:
3 replacing, in the packet, a data link layer destination address associated with
4 the router with the data link layer address associated with the second
5 device; and
6 replacing, in the packet, a data link layer source address associated with the
7 device with a data link layer address associated with a port of the router
8 that is connected to the second virtual local area network.

1 9. The method of Claim 7 further including the step of forwarding the packet to
2 the router if configuration information has not yet been stored for the network
3 layer destination address.

1 10. The method of Claim 7 further comprising the step of determining whether
2 proxy forwarding is active, and performing the step of forwarding the packet
3 to the second device through the second port only if proxy forwarding is
4 active.

1 11. The method of Claim 6 further comprising the steps of:
2 receiving from the router a response packet to the packet, the response
3 packet including a data link layer address associated with the
4 particular port of the router;
5 inspecting the response packet to determine the data link layer address
6 associated with the particular port of the router;
7 storing data that indicates that the data link layer address of the
8 particular port corresponds to the network layer address of the
9 particular port; and
10 forwarding the response packet to the device through the first port.

1 12. The method of Claim 11 further comprising the step of storing data that
2 indicates that the virtual local area network is connected to the particular port
3 based on information contained in the response packet.

1 13. A method, for use by a learning internetwork switch, for performing proxy
2 forwarding between a first device on a first virtual local area network and a
3 second device on a second virtual local area network, where the first virtual

4 local area network and the second virtual local area network are locally
5 attached to the learning internetwork switch, the method comprising the steps
6 of:
7 receiving a packet from the first device that specifies a network layer
8 destination address and a data link layer destination address, wherein
9 the specified network layer destination address is a network layer
10 address associated with the second device and the data link layer
11 destination address is a data link layer address associated with a first
12 port of a router connected to the learning internetwork switch;
13 performing a lookup operation to determine a data link layer address associated
14 with the second device;
15 if the data link layer address associated with the second device is found during
16 the lookup operation, then
17 changing the data link layer destination address specified in the packet
18 to the data link layer address associated with the second device;
19 and
20 forwarding the packet to the second device over the second virtual local
21 area network.

1 14. The method of Claim 13 wherein:
2 the packet specifies a data link layer source address, wherein the data link layer
3 source address specified in the packet is a data link layer address
4 associated with the first device;

5 a second port of the router is connected to the second virtual local area
6 network; and
7 the method further comprises the step of changing the data link layer source
8 address in the packet to a data link layer address associated with the
9 second port prior to forwarding the packet to the second device.

1 15. The method of Claim 13 further comprising the step of learning a location of
2 the second device prior to receiving from information contained in a previous
3 packet transmitted by the second device.

1 16. The method of Claim 15 wherein the step of learning includes the steps of:
2 receiving at a particular port of the learning internetwork switch the previous
3 packet;
4 determining that the previous packet is addressed to a particular port of the
5 router;
6 reading a data link layer source address and a network layer source address
7 from the previous packet;
8 storing data that indicates that the data link layer source address is the data link
9 layer address associated with the network layer source address;
10 storing data that indicates that the device associated with the network layer
11 source address is connected to the particular port of the learning
12 internetwork switch;

- 13 storing data that indicates that the device associated with the network layer
14 source address is connected to the particular port of the router.

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